JOURNAL OF WOMEN'S HEALTH & GENDER-BASED MEDICINE
Volume 10, Number 1, 2001
Mary Ann Liebert, Inc.

The Millennium Series

Information Technology and the National Centers of Excellence in Women's Health

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ABSTRACT

Women are increasingly turning to the Internet for health information. The National Centers of Excellence in Women's Health (U.S. Dept. of Health and Human Services) have as one goal the use of information technology to improve care of women. Telemedicine, the Internet, and Resource Centers were used for patient consultation, patient support, support of women in academics, and clinician education regarding women's health. Access of the lay public to high-quality health information was achieved using the Internet as well as Resource Centers employing Internet educational modalities. Telemedicine, distance learning for clinicians and patient consultations for those far from medical care, has been used successfully. For clinicians, continuing medical education regarding women's health and calendars of opportunities for education in women's health were made available on-line. Creative new uses of information technology have been developed by the Centers of Excellence in Women's Health. These modalities may be adopted, tested, and adapted by others seeking to improve the care and health of women.

INTRODUCTION

THE AREA OF WOMEN'S HEALTH moves at a rapid pace, presenting both clinicians and patients with ongoing struggles to keep current with new developments. Because information technology can provide education, access to services, promotion of research development, and continuously updated material, information technology has begun to take its place in the area of women's health.

In the United States, women make 80% of healthcare decisions and about 60% of healthcare purchases.[1] Many leading sites have mostly female visitors and aim to reach a primarily female audience.[1] It is projected that by 2003 women will be responsible for $579 million or 60% of the on-line prescription drug purchases, and $186 mil-

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Since this manuscript was submitted, Ohio State University, University of Maryland, and Yale University are no longer National Centers of Excellence in Women's Health.

The URLs (uniform resource locators) for the currently funded Centers of Excellence in Women's Health websites may be found at: *www.4woman.gov/owh/coe/index.htm*

lion or 59% of over-the-counter drugs.[1] Women aged 50 years and over are a fast-growing segment of the online population.[2]

The Council on Graduate Medical Education has identified several concerns regarding women's health.[3] First, women have difficulty receiving comprehensive care as a result of deficient physician training and fragmented care, so that primary care physicians need to have a broad understanding of issues relating to women's health. Providers of primary care for women need to have competency in and ongoing education about women's health.[3]

Compounding the problem of lack of physician education in women's health is the fact that women are underrepresented in research, so that there is lack of gender-specific information about diseases. Thus, promotion of research in women's health is a second critical goal.[3]

Third, the proportion of the U.S. population of racial and ethnic minorities is dramatically increasing. This segment of the population has lower life expectancy and more health problems in addition to poorer access to care. Some mechanism must be put in place to deal with the provision of adequate healthcare under these circumstances.[3] Innovative clinical models for comprehensive healthcare of women, including prevention, community approaches, and education, are required.

Lastly, the projected 8-fold increase between 1970 and 2010 in the number of women entering the medical profession will increasingly affect all aspects of medical education, research, and practice. The number of women physicians is expected to rise to nearly 100,000 in 2010 compared with 25,500 in 1970. The corresponding percentages of women among all physicians will increase to 29% from 8%.[3] In addition, women physicians are still underrepresented among leaders in medicine. Women physicians need a mentoring process encompassing the entire spectrum of training from students to junior faculty members. The dual and inextricably linked goals of improvement of quality of healthcare for women and promotion of the status of women physicians are of great importance.

In alignment with these priorities and concerns, the National Centers of Excellence in Women's Health (CoEs), U.S. Department of Health and Human Services (DHHS), have been working via several venues toward all these goals regarding the promotion of women in medicine and women's health in general. Information technology is one of these venues. The Internet is a powerful means already in place that could be exploited to accomplish such goals. As pointed out, very often the method employed and desired by patients makes use of the Internet.

This article describes the experiences of several of the CoEs specifically in the area of use of information technology (IT) as it relates to the accomplishments of the outlined goals. These CoEs include Ohio State University (OSU), Yale, University of California at Los Angeles (UCLA), University of Maryland, and University of Wisconsin. It is hoped that those wishing to make use of technology to design a successful program may derive some benefit from the following techniques.

APPROACH TO THE PROBLEM: THE MANY FORMS OF INFORMATION TECHNOLOGY IN WOMEN'S HEALTH

All CoEs had existing technology in place before their CoE designation. With the CoE designation, the CoE were contractually required to focus on creating an integrated system. The CoEs work to foster and enhance better communication among all communities that interface with women's health or women's health research. Targets include individuals or groups within the academic community, across departments and schools at their university, and at other institutions, and community groups, professional organizations, policymakers, and individual consumers.

The CoEs have used technology to further women's health by increasing consumer and professional access to information and by increasing women's access to care itself (Tables 1 and 2).

General education was accomplished via information technology by use of resource centers (Table 1). The individual CoE resource centers developed creative, unique approaches. For example, a feature unique to UCLA's Women's Health Education and Resource Center (WHERC) is the use of preprinted patient education prescriptions. These prescription pads, which are kept in neighboring clinics, are printed with a selection of popular patient education materials that a physician can chose from by checking the appropriate box and signing the prescription. The patient can then fill the prescription at the WHERC. The pre-

TABLE 1. INFORMATION TECHNOLOGY AND RESOURCE CENTERS

Preexisting structure	*Rationale for new developments*	*Resource center accomplishments*
University of California, Los Angeles Iris Cantor-UCLA Women's Health Center, Women's Health Education and Resource Center space, jointly donor and university supported	Need for: Community (off campus and other departments) to be better linked to academic center Lay and clinician lectures Lay and clinician education via the Internet Unique and extensive ways of using a resource center and webpage Presentation of mentoring opportunities for female faculty and trainees Research database to be more widely available Public to be more aware of available clinical resources Patient support groups	Electronic, video, and printed health information Information includes all areas pertinent to women, including the concerns of their male loved one Health information available free of charge Trained staff to help access information Computer access for the public Lay lecture series and support groups Capability of mailing information to those unable to access center or webpage Touch terminals for the disabled or inexperienced Newsletter mailed to community/patients Guide to using the Internet assembled and posted at each computer terminal, including guidelines for judging reliable health information
Ohio State University Ohio State Medical Center had a website in place prior to CoE designation. The webpage was developed within 18 months, and information was updated. Most of the telemedicine and teleconferencing infrastructure already operational and well supported by the instutition	Need to: Increase consumer and healthcare access to women's health information and resources	Trained staff using Internet resources and on-site libraries
Yale University Videoconferencing studio, mobile videoconferencing equipment, wired classrooms, auditoriums and clinical spaces; had a well-developed technical infrastructure for videoconferencing and live broadcasting. Although the CoE had only two dedicated technical people, it had access to a knowledgeable ITS department with sufficient personnel to supply all desired services. The CoE needed to create a website to establish programs that could use existing Internet and videoconferencing technology	Need to: Integrate information technology into every area of women's health program. Allow collaboration with telemedicine programs for education of clinicians, case management, and patient triage Assess role of information technology in improving quality of care	No resource center

(*continued*)

Table 1. (Cont'd) Information Technology and Resource Centers

Preexisting structure	*Rationale for new developments*	*Resource center accomplishments*
University of Maryland No resource center	Need to: Incorporate new technologies and increase knowledge base of healthcare professionals Assess use of telehealth in men vs. women Integration with outlying medical centers to aid trauma care, image management, and communication	Resource center
University of Wisconsin Well-established clinical services for women's health (obstetrics to geriatrics) Research and training programs in women's health (Women's Health Initiative, Women's Health Fellowship; postdoctoral training program in women's health) Campus culture favoring interdisciplinary research	Need to: establish a Website that is user-friendly for clinical, education, research, and community outreach, continuing education for clinicians	Trained staff using Internet resources and on-site libraries Computer access to the public Teen website in English and Spanish Calendar Research resource booklet On-line discussion forum Bibliography of cultural competence Videotaping of interdisciplinary Women's Research Colloquium Videoconferencing of Women's Health Forum to two sites

scriptions are appreciated and enjoyed by both physicians and patients.

All the CoEs have created women's health websites as a resource for consumers and healthcare professionals to access health information, educational resources, service information, and links to further sources of information. In addition to inclusion of this basic information, CoEs have further developed certain resources on their webpages (Table 2). These resources include health education information for both healthcare professionals and the public, interactive patient-geared sites, use of websites to foster collaborative efforts among healthcare professionals, and enhancement of awareness of research opportunities. Programs in distance learning, some of them interactive, also have been developed (Table 2). Telemedicine has been employed to increase access to healthcare, especially state-of-the-art healthcare and specialty care for underserved urban and rural populations (Table 2).

RESOURCE ALLOCATION AND TIME REQUIRED FOR OPERATIONAL STATUS

The CoEs required vastly different resources, as was predictable by different uses of IT. Yale encouraged the CoE to enhance its programs through collaboration with the many existing programs at the university rather than through extensive unique funding. This proved a successful arrangement, bringing together a number of both small and large programs that shared lecturers and personnel and brought added value to both programs. Yale did, however, allocate funding to the technical development of the CoE in two ways: (1) funding for technical services, including website development and videoconferencing fees, and (2) funding for a percentage of staff time for a technical director for the CoE. There was no institutional funding given to the CoE for wiring additional rooms with fiberoptic and ISDN (integrated services digital network) connections, as this was part of a broad institutional telecommunications plan.

Development of the OSU CoE website was accomplished with a CoE program coordinator, a program manager in hospital communications and marketing, and a group of technology consultants. CoE resources supported the program coordinator, and the hospital supported the communications and marketing and technology consultant staff. Telemedicine and teleconferencing were entirely hospital supported, that is, independently financed external to the CoE.

Table 2. Website and Telemedicine Accomplishments

University of California, Los Angeles	Clinician education resource links; women's health continuing education calendar for clinicians, CD-ROM and journal links pertinent to women's health; women's health newsletter on-line; library of one-line patient education pamphlets and resource links; academic database of female faculty; campus research database; regional and national women's health resource list; signup for mentoring program on-line for female trainees and junior faculty; women's health Internet update weekly posting of women's health news from multiple Internet sources for physicians; calendar of lay lectures taking place in resource center
Ohio State University	Extensive patient education handouts on-line; interactive consumer health information service collaboration with other Institutions (*www.netwellness.org*) with Ask the Expert generating e-mail response, available at multiple libraries; Ohio Medical Education Network employing phone teleconferencing, satellite television, and Internet to supply continuing medical education on women's health topics; abaility to participate in broadcast lectures and conferences; e-mail mailing lists (listservs) of faculty interested in women's health used to post funding opportunities and campus, local, and national women's health events; enhancement of clinical trial opportunities by on-line education of patients; research funding opportunities; researcher expertise searching capability; telemedicine for care of populations at correctional facilities
Yale University	Regional and national women's health resources list; collaboration with another Institution on a monthly newsletter (*HealthLINK*) including women's health, maternity, and lactation topics as well as information on tests and procedures; ability to participate in broadcast lectures and conferences; broadcasts lectures live internationally; weekly teleconference patient care discussions; remote clinical training; posting of women's health course syllabi; enhancing communication between women's health researchers and students; interactive lectures and procedure training with extensive technical infrastructure; collaborative project (New Haven Public Health Project) listing vital statistics on key health topics; electronic mailing list; videoconferencing with urban area hospitals for real-time clinical consultation; telemedicine collaboration with physicians in Argentina
University of Maryland	Extensive Frequently Asked Questions section; links to medical journals, references, research funding information, and educational fellowship information; calendar of events; Teleoncology Network videoconferencing system for enhancing rural population cancer care; real-time interactive video telepsychiatry for remote child psychiatry; computer-assisted telephone interview facility to collect information to plan rural telemedicine program
University of Wisconsin	Listservs (electronic mail mailing lists) of faculty interested in women's health used to post funding opportunities and campus, local, and national women's health events; ability to participate in broadcast lectures and conferences; distance education facilities for practitioners to hear lectures; distance learning interactive with instructor

UCLA had a part-time webmaster devoted solely to maintenance of the webpage, and the webpage content was supervised continuously by a physician.

Time required for operational status varied across the CoEs. For example, the Yale CoE's website was developed over approximately a 6-month period. It took about one semester to set up and schedule videoconferencing of clinical conferences. Program collaborations with other departments at Yale began almost immediately in the first year of the CoE and grew steadily throughout the contract term.

At OSU Medical Center, the website was operational within 12 months. UCLA's website was developed over 6 months, then continued to be developed on an ongoing basis, with expansion for a women's health research database, a list of female faculty, and additional resource listings for the laypublic and clinicians. As an example of the funds required to set up and maintain the website, the UCLA CoE paid $24,836 for the first 3 years to the webdesigner and webmaster. The UCLA WHERC existed prior to the CoE designation.

WHAT OBSTACLES WERE FACED BY THE CENTERS OF EXCELLENCE?

Centers have encountered many challenges within their institutions and the surrounding community in developing or enhancing their use of technology, particularly in the areas of communications, commitment of resources, and actual cost of technological services. Communication among ongoing programs within the institutions has been one of the greatest challenges. Sharing information about educational programs and coordinating healthcare opportu-

nities for women on campus has been especially difficult. At times, collection of data on the types of women's health services that are provided on campus was challenging. Campus programs did not always have websites with which to link.

Maintaining the website, that is, ensuring the accuracy and timeliness of information, is critical to success and requires considerable dedication of resources. In itself, the process of deciding which of the rapidly proliferating Internet site links to post on each website was difficult and labor intensive. Maintenance of a website requires a commitment by the institution to sustain the personnel necessary to achieve success. This meant that a devoted webmaster whose sole job was maintenance of the CoE webpage already had a full agenda.

Resistance to change was encountered, but some barriers were overcome by communicating to health professionals the various ways in which technology could enhance the practice of healthcare. Training sessions were held, making practitioners more comfortable with the technology available at their institution and identifying new ways to integrate technology into their work.

Too many priorities and two few resources are cited as the major obstacles in implementing technological changes within the institution and the community. A national investment in establishing the infrastructure is needed to provide care in rural areas. At times, federal agency mandates and insurance restrictions for care reimbursement made significant use of telemedicine capabilities financially restrictive. Installation of equipment was expensive, and operating expenses were often prohibitive. Some programs, such as the telemedicine program at OSU, were unable to be expanded to their maximal potential because of lack of reimbursement.

FUTURE ROLE OF INFORMATION TECHNOLOGY IN WOMEN'S HEALTH

The CoEs represent considerable diversity not only geographically but also in the clinical care and educational models they have developed and in the patient communities they serve. Thus, it is important to examine the common areas of concern for the future shared by the CoEs as well as their divergent perspectives.

There is general agreement among the CoEs on the need to extend educational activities beyond the campus and to increase opportunities for collaboration. CoEs mentioned the importance of collaboration both internally within their institutions and externally to local and virtual communities of women and healthcare providers.

More effective communication and better integration of IT into healthcare services are the ultimate goals of most CoEs. The use of IT shortens the distance between people and can improve healthcare delivery to women by providing continuous rather than episodic care, improving access to clinical services and healthcare information to women in underserved areas, and establishing community networks. It is absolutely critical that those interested in pursuing IT along the lines of the CoEs recognize early the need for abundant devoted resources to successfully maintain a well-designed, up-to-date website. A webmaster whose duties are split between multiple webpages and other responsibilities will most definitely not be sufficient.

Many of the CoEs currently are engaged in telemedicine activities within their own states and internationally, and all of them hope to augment their programs in the future. As mechanisms for reimbursement become available, development of videoconference consultations will probably be enhanced. The Internet is also expected to play a major role in the growth of remote clinical services.

The CoEs would like to experiment with new ways to deliver web-based teaching materials to patients other than through personal computers in the home or workplace. A clinic computer for public use could accomplish several things: (1) as an interactive website, it will provide a database for the clinic, (2) it will become a computer resource for the community, and (3) it offers a way of teaching the general public—people who may not have any other access to a computer—how to use a computer and how to navigate through the Internet to find healthcare information. The CoE that have already installed clinic kiosks in or adjacent to their clinics, such as the University of Maryland, OSU, and UCLA, report significant use and believe that women's easier access to current information will result in improved care.

Using IT for professional education for physicians, staff, and nonphysician healthcare providers is a priority for most centers. IT appears to be an effective way not only to increase educa-

tional efforts for medical staff but also to help reduce staff misconceptions and reluctance to use available technologies.

Potential students can be found in community colleges, public schools, state colleges and universities, health departments, and hospitals. In some states, such as Ohio, Maryland, and California, such networks are well established and well funded. In other states, programs are still being developed. There is some concern among the CoEs that the reasons for the slow response to current efforts, including inadequate funding, poor infrastructure at the regional or state level, inexperienced personnel, and lack of cost-benefit justifications, may continue to impede rapid future development.

One strategic advantage the CoEs share is that the success of some can be used to demonstrate a program's effectiveness to the others, thereby accelerating institutional change.

Creation of more robust databases that could serve a variety of communities is anticipated. Increased use of the Community of Science (COS) system is considered particularly important for women's health, as it will help university researchers to become aware of the services available to them and to enter and maintain their profiles into the expertise database. Use of the COS system will be especially important as the CoEs move forward as a group with a vision of a National Center research database.

At some of the CoEs, lists of all female medical school faculty are being maintained, as is a database of all ongoing campus research. OSU and UCLA would like to use databases to augment research applications, both CoEs having an on-line directory of clinical trials on campus. This database would expand the current initiative and foster recruitment of women into clinical trials.

All the CoEs agree that additional mutual links with other agencies and universities, as well as within individual medical centers, need to be established or expanded. The creation of these networks will enable researchers to share information with others at different locations, bring together greater numbers of medical personnel in education and training sessions, and reach vast numbers of consumers.

CONCLUSIONS

In general, the CoEs would like to expand on and off campus use of current programs and increase the use of comprehensive information technologies in many of their education, outreach, and research efforts.

The future goals for providing women's healthcare do not differ substantially from the present ones: to provide the best possible patient care, to keep physicians' and staff skills state-of-the-art, to offer new services in a timely way, and to provide better access to healthcare for everyone. IT can certainly be further exploited in new and creative ways to meet these goals.

Regardless of the particular type or form of program, the emphasis should be on building networks that strengthen connections among the different entities engaged in the delivery of healthcare, such as researchers and clinicians, universities and government agencies, academic physicians and community physicians, and major tertiary care centers and neighborhood clinics. There is a general belief that the CoEs can work cooperatively to pilot programs that create new communities of interest. It is hoped that other institutions can also participate in this undertaking and find our experiences useful.

ACKNOWLEDGMENT

We thank Michelle Gailiun for her contributions toward the Ohio State portion of this report.

REFERENCES

1. Restrepo D, Patel V. Jupiter analyst report-health-vol 1 online projections. New York: Jupiter Communications, LLC, 1999:1063.
2. Teicholz N. Library/web sites for women: Women want it all, and it's all on line. New York: New York Times, 1998 pp 1–2.
3. Council on Graduate Medical Education. Fifth report: Women & medicine. Washington, DC: U.S. Department of Health and Human Services, 1995:1.

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